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A Journal of Small Power Engineering

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# The MODEL ENGINEER

*Edited by*

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## SMOKE RINGS

A REMARKABLE collection of miniature Chinese models has reached me from Mr. Moore Bennett, of Pekin, who kindly sends them as an example of the cheapness of Chinese production. The models are made in clay, stiffened where necessary with wire, and represent men, animals and birds in great variety. The subjects are excellently modelled and brilliantly coloured. They range from ¼ in. to 1 in. in height, according to the subject. There are thirty models in the collection, and the whole lot cost the remarkable sum of sixpence, at the rate of one-fifth of a penny per piece. Mr. Moore Bennett says: "Tell me if there is anyone anywhere in Europe or the civilised countries where they can equal or surpass these at ten times the price for reality to truth." I doubt whether these models could be equalled anywhere at the price, but naturally the cost of living enters very largely into the question, and it would be interesting to know the standard of living which the production of such work enables the craftsman to attain. The cost of the materials is infinitesimal, and I have no doubt that the deftness of the worker enables these dainty figures to be modelled rapidly. But even so, I should imagine that there is at least half a day's work in the six-pennyworth sent to me, and a shilling a day does not indicate a very luxurious mode of living. Anyway, I am very much indebted to Mr. Moore Bennett for sending me such an interesting display of native ingenuity.

* * *

Some of my readers whose household accommodation is limited are occasionally puzzled to know what to do with accumulated copies of back numbers of THE MODEL ENGINEER. Here is a solution of the difficulty adopted by Mr. John J. Atkinson, a consulting engineer, of Liverpool, which has much to commend it. He writes: "I have been making a practice of packing twelve months' MODEL ENGINEERS, in order to reduce the very large numbers in my possession, and sending them to the Chief Engineers of both motor and steam ships, with which I am connected, and have received letters, in which the Chief Engineer on behalf of himself and juniors, expresses his kind appreciation of their contents, more especially the practical notes, from which they have made some special articles frequently required on board." I much appreciate this thoughtful action on Mr. Atkinson's part, and am glad to know that THE MODEL ENGINEER is so much appreciated by the recipients. We have many readers in the engine-rooms at sea, and the concluding sentence of Mr. Atkinson's letter indicates once again how frequently model engineering helps in real engineering.

* * *

The recent influenza epidemic has brought me several testimonials to the value of THE MODEL ENGINEER as a companion in the period of convalescence. Mr. Henry B. Selden, a distinguished American artist, living in New London, Connecticut, writes reminding me of a pleasant chat we once had together in my office. He goes on to say: "The reason for this very long letter is that I am just sitting up after a 'go' with influenza. For a person who leads an active varied life it is so very trying to 'sit around,' but it has given me a chance to look over many of my precious and ever-growing collection of THE MODEL ENGINEERS, and I wanted to tell you what pleasure it has given me now for the past ten years, and how much information. I wonder how many of your correspondents have told you how much pleasure they have also had from it on the *literary side*."

Mr. E. Didcote, of Woking, pays THE MODEL ENGINEER a similar tribute. He writes: "I have just recovered from a fairly bad bout of influenza, and during the period of recovery, when 'Mrs. Model Engineer' would not allow me to get up and tinker about in the workshop, I lay in bed and read all the past issues of 'Ours' that I have in my possession. These are in almost unbroken sequence since 1920 with sundry odd numbers before that, and I can assure you the perusal of them helped to pass the time between meals, sleep, and sneezing, in a most delightful way. One thing that struck me as peculiar during this period is the comparative absence of 'fashions' in model-making—there would appear to be no 'nine-days' wonders' about our hobby. There were model locomotives, model stationary engines, model marine engines, and the like, when I was very young, though these were, of course, of crude design compared with those of to-day. These things have developed in design—they have not dropped out of notice to give place to a craze for something else. Another thing that struck me as remarkable was that for a technical paper 'Ours' is an intensely 'friendly' institution. Reading it, one feels one *knows* everybody in it, or as though we were all gathered together in a highly concentrated haze of 'Smoke Rings' discussing all the knotty problems that confront us from time to time." I have cut out from both those letters some kindly personal compliments intended for my eye alone, but it is pleasing to find that the spirit of THE MODEL ENGINEER so wonderfully maintained by my many contributors and correspondents, is so deeply appreciated wherever the paper goes. I can see the medical profession prescribing a course of MODEL ENGINEER reading to invalids, in place of the usual tonic, and they might do very much worse.

* * *

An interesting cutting from *The Hampshire Chronicle* reaches me from Mr. H. S. Bond, of Winchester. In a reprint of the news of 100 years ago is a reference to a model steam carriage built by Mr. W. Allee, which was being exhibited to raise funds for his destitute widow and children. In 1829, the paper said: "The machine is a wonderful specimen of ingenious mechanism and neat workmanship. Particularly when it is considered that the deceased was deprived of his right hand by an explosion about four years since." In that same year the *Chronicle* also reported that: "A gunsmith of Easingwold, Yorkshire, has invented a species of artillery to fix in coffin lids which will explode and blow up any resurrectionist that may attempt to invade the sanctity of the grave, without the least damage to the coffin."

* * *

Another model reported to have been built in 1829 is a model locomotive made by Robert Stephenson & Co. to the order of Michael Longridge, and sent to Mr. Geo. Buchanan, of Edinburgh. In a recent letter to the *Scotsman*, Mr. J. G. H. Warren, of 97, Lansdown Road, Bath, enquires if anyone can give him information as to the present whereabouts of the model, which he rightly says would be of great historic interest. Possibly some of my readers may know something about this model, or about the recipient, Mr. George Buchanan, and may be able to help Mr. Warren to trace it.

* * *

In a recent issue of the *Daily Express* it was related that the rent of a house on the Downham Estate, Bromley, was raised 2s. 6d. a week because a schoolboy living in the house did some fretwork in his spare time and sold it to a neighbour. The increase in rent appears to be a penalty imposed by the London County Council if premises are used for carrying on a trade. The full facts may not be disclosed in the above news item, but to interpret the sale of a schoolboy's piece of fretwork as "carrying on a trade" certainly seems to be a very arbitrary decision. The case raises an interesting point in connection with hobbies or spare-time occupation carried on in a private house, where the lease or agreement may contain a clause prohibiting the use of the premises for trading purposes.

* * *

A fortnight or so ago I spent an enjoyable couple of hours with the Hounslow Model Railway Club on the occasion of their third Annual Exhibition. They had a very good show of members' work, and a 48-ft. steam and electric track in o-gauge in full operation provided plenty of entertainment for the numerous visitors. I was entrusted with the duty of making the opening speech, and I believe some of my hearers were rather surprised at what I was able to tell them about the recent growth of the model railway hobby, not only in this country, but in many places overseas. Mr. Henry Greenly also spoke, and said that as a new resident in Hounslow he would be very pleased to support the club and help it in any way he could. I hear of new Model Railway Clubs being formed at Nottingham and Bristol, and of increases in the membership strength of several model engineering societies. This is all to the good of the cause.

* * *

London readers must not overlook the forthcoming Exhibition organised by the Model Railway Club, to be held at Kingsway Hall in April. It opens on the afternoon of the 17th and closes on the evening of the 20th. There is always a first-class show of railway model-making on these occasions, and I understand that this year's Exhibition will be quite up to standard.

Percival Marshall

# LOCO. PROTOTYPES NEWS and NOTES

By Chas. S. Lake, A.M.I.Mech.E., M.Inst.L.E.

### New Shunting Locomotives for the London Midland and Scottish Railway.

The writer suggests that the new type of shunting engine, the first of which has recently been completed at the Derby works of the L.M.S. Railway, is a particularly suitable prototype on which model engineers can exercise their skill.

The locomotives are numbered 11270/11279 inclusive. They represent an entirely new class and have been specially planned for operating under the somewhat exacting conditions which obtain in docks and goods yards.

### Special Features of Design.

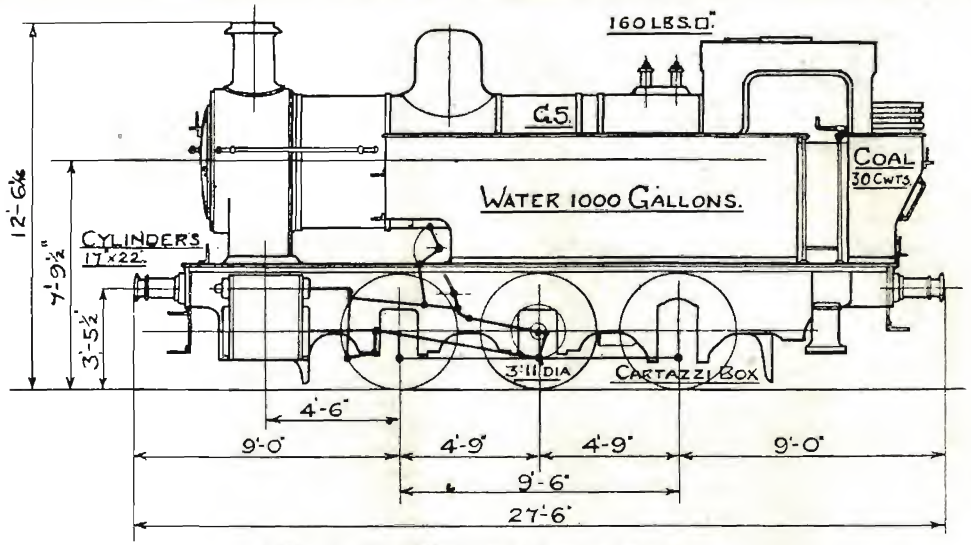
Locomotives built for traffic of the kind referred to must have a short wheelbase to enable them to negotiate curves of small radius, and as their work involves such a large amount of stopping and starting, often with heavy loads, they must be able to develop the requisite tractive force. Flexibility is one of the principal considerations, and to meet this the L.M.S. engines have their wheels grouped closely together, whilst the trailing axleboxes are of the Cartazzi type, permitting of added freedom of movement at that end. With the same object in view, the coupling rods are ball jointed so that, although there are no bogie wheels at either end, the engines should be able to meet the demands imposed upon them where facility in traversing curves is in question. Some of these curves are as small as 2½ chains (165 ft.) radius, and as regards tractive force, although the engine is of relatively small overall proportions, a tractive effort of 18,400 lbs. is achieved.

### Other Leading Characteristics.

Cylinders measure 17 ins. diameter by 22-in. stroke, and steam is distributed to them by Walschaerts gearing outside the frames, slide valves working above the cylinders being employed. A standard type of boiler with Belpaire firebox is fitted, and all standard fittings such as Ross "pop" safety valves, water gauges, etc., have been used. The boiler is not fitted with superheating apparatus; it has a total heating surface of 1,088 sq. ft., of which 923 sq.ft. are in the tubes and 85 sq. ft. in the firebox. The grate area is 14.5 sq. ft.

The coupled wheels measure 3 ft. 11 ins. diameter on tread, and the wheelbase is restricted to 9 ft. 6 ins., the total overall length of the engine being 27 ft. 6 ins., its maximum height 12 ft. 6 1/16th ins., and weight in working order 43 tons 12 cwts. Steam sanding gear is applied to the end wheels. The tanks hold 12,000 gallons of water, and the coal bunker 30 cwts. of fuel. The boiler carries a working pressure of 160 lbs. per sq. in.


One of the New Shunting Locos for the L.M.S.




Outline Elevation of New Shunting Loco for the L.M.S.

### A Converted 4—6—0 Type Locomotive.

The Great Southern Railways of Ireland locomotive No. 402 of the 4—6—0 express type originally built with four cylinders has recently been converted at the Inchicore works to a two-cylinder engine. It was built in 1921, and has run since then as a four-cylinder engine.

With the purpose of ascertaining what economy in working could be effected, this engine was, as stated, rebuilt with two cylinders, and the chief mechanical engineer, Mr. Bazin, has informed the writer that the results have fully justified the alteration. A remarkable reduction in coal and water consumption has been shown, whilst shed repairs have been reduced to a minimum. The boiler remains as before, but a larger type of tender has been fitted, this having a capacity of 4,500 gallons of water and a coal capacity of 8 tons.

The original cylinder dimensions were: diameter 14 ins. and piston stroke 26 ins., but now that the two cylinders have taken the place of the four previously fitted, the cylinders measure 19½ ins. by 28 ins. The total heating surface is 2,098 sq. ft., weight of engine and tender in working order, originally 112 tons 8 cwts., now 121 tons 10 cwts. The tractive effort, at 85 per cent. boiler pressure, has been raised by the conversion from 19,190 lbs. to 20,620 lbs.

---

### A New Irish Tank Engine.

By the courtesy of Mr. J. R. Bazin, chief mechanical engineer of the Great Southern Railways, Ireland, it is possible to reproduce a photograph and dimensioned drawing of the first of a new series of tank engines built at the company's works at Inchicore, Dublin, and specially introduced for working passenger trains on the Cork, Bandon and South Coast, Dublin and South-Eastern, and other sections

G.S.R. of Ireland Loco, converted from Four to Two Cylinders.


A New Irish Tank Locomotive.

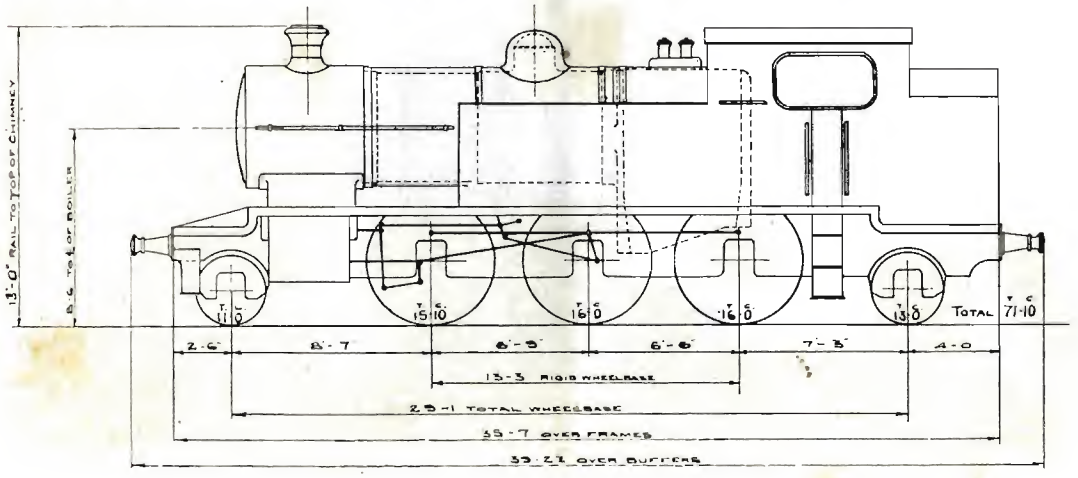
of the Great Southern system, where short-distance passenger traffic exists.

The new engine, as seen, is equipped with outside cylinders driving the middle pair of coupled wheels. Steam distribution is effected by overhead piston valves operated by Walschaerts gearing, the valves having a diameter of 8 ins. The cylinders are lubricated by means of a three-feed Detroit vacuum lubricator, and the axleboxes by a Wakefield mechanical lubricator. This latter is driven from the expansion link of the valve gear and has six feeds.

The engine has modern characteristics throughout. The boiler is equipped with superheating apparatus and the total heating surface, including the superheater, is 1,056 sq. ft. The firebox is of the Belpaire type with Ross patent pop safety valves mounted upon it, the grate area being 19.75 sq. ft. The cylinders have a diameter of 17½ ins., but with a piston stroke of 28 ins. their volume is larger than the diameter alone would indicate. The coupled wheels measure 5 ft. 6 ins. diameter on tread, and the leading and trailing wheels 3 ft. 1 in.

The boiler carries a working pressure of 160 lbs. per sq. in. In working order the engine weighs 71 tons 10 cwts., and it will be noted from the drawing that the heaviest axle load is 16 tons, this loading being carried by the driving and trailing coupled wheels. The tractive effort, at 85 per cent. of the boiler pressure, is 17,670 lbs.

The water capacity of the combined tanks is 1,700 gallons, and the coal bunker carries 3 tons of coal. A roomy type of cab is fitted, and the engines, generally speaking, present a compact and well-set-up appearance.




Outline Elevation of New Irish Tank Loco.

# A LOW-VOLTAGE LIGHTING PLANT.

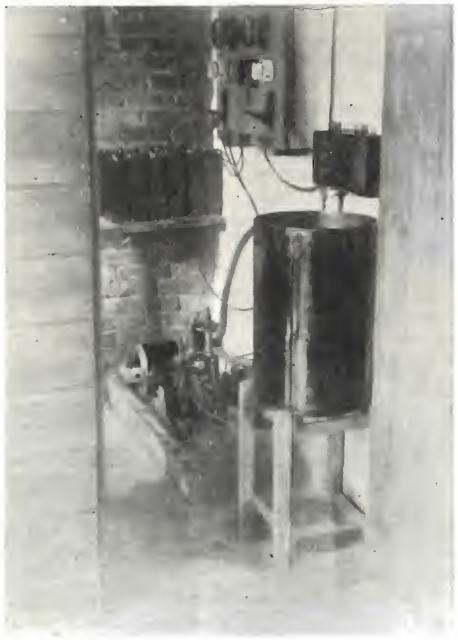
By R. G. Selman.

The small lighting plant to be described was commenced in my spare time more or less as a hobby, and I finished by wiring the house of fourteen rooms and making up a complete plant.

The first things to be obtained were two Rotax aeroplane dynamos with a reputed output of 12 volts 18 amperes each ; as the connections and wiring of these machines were rather beyond my comprehension, I decided to scrap the old windings together with the third brush. They were then rewound with a plain shunt winding, and mounted on a piece of steel plate face to face with a 4-in. cast aluminium pulley on one shaft coupled to the other with a flexible coupling made of a disc of leather.

The next things to come along were twelve Edison nickel-iron-alkaline accumulators, 75 ampere-hour capacity, 1.2 volts per cell. These formed the basis of the plant, the voltage was limited to 12 owing to the high cost of extra accumulators and the impecunious state of the writer at that time ; this has been found quite satisfactory providing the wiring, of good stout gauge wire, is well carried out. The bulbs used were car head and side lamp ones, ½, 1, 2 and 3 amperes consumption, all except the ½-ampere ones being gasfilled. These may be obtained with large bayonet caps, so that it is possible to use standard shades and fittings. Three - ampere bulbs were found to give a very good light for a sitting or dining room, 1 or 2-ampere ones in the kitchen or bedrooms, and ½-ampere in pantry, scullery, hall, etc. These bulbs have a very small filament specially made for focussing in car headlamps, the light therefore appears rather intense and casts very sharp shadows ; this was overcome by using bowl pattern shades similar to cut glass, which are sold by the trade name of Holophane. The plant was housed in my workshop, and the main to the house consists of heavy twin lead-covered cable ; this leads to a distribution board in a central position on the ground floor and thence to another situated in the attic, which supplies the bedrooms. Practically every lamp is on a separate circuit led from the distribution boards, this helps to obviate the slight flicker usually found with a low voltage system when switching extra lights on. The house wiring is carried out with a twin 3/20 rubber-covered cable called Maconite, and wherever possible it is run under the floorboards, behind the skirting, etc., where this is impossible it is covered with wooden casing.

The switches were of the best quality quick-break tumbler type in various finishes to match the style of the rooms. The dynamos were driven by a hopper-cooled farm engine of about 2½ h.p., with a 30-in. wooden pulley bolted to the flywheel, as it was necessary to drive the dynamos at over 3,000 r.p.m. to obtain a total output of 300 watts. A rough switchboard was made from a piece of three-ply and fitted with volt and ammeters off an old car-lighting set. Difficulty was experienced in keeping the dynamos cool when run for several hours at a time, but was finally overcome by drilling some holes in the driving side endplate and fitting small fan blades on the sides of the pulley, thus drawing air through the windings. This cured the overheating trouble and they were used throughout one winter.



"The Generating Station."

During the next summer a better dynamo was obtained (through The Model Engineer "For Sale" columns), this was a ball-bearing shunt-wound machine 20 volts 15-20 amperes output at about 1,250 r.p.m. Then I exchanged one of the aero dynamos for a set of partly finished castings for a Universal two-stroke engine, 2¼-in. bore by 3-in. stroke. The machining, etc., was finished off and the engine assembled, a carburettor and a magneto obtained and fitted. The engine and dynamo were mounted on two lengths of angle-iron about 4 ft. long, bolted together with two bolts and 6-in. lengths of tubing as distance pieces. The angle-iron is slotted to allow of

the dynamo being adjusted to tighten the belt. The pulley on the dynamo is of hard wood, as I have found there is no trouble from belt-slip if this is used. The exhaust pipe is carried through the wall and into an old five-gallon oil drum buried in the ground outside, a vertical pipe leading from it to a height of about 10 ft. with a bend at the top. This silences the exhaust fairly well, but it was found necessary to put a silencer of sorts on the carburettor, as the suction caused a lot of noise. The whole plant is fixed on a concrete foundation about 6 ins. high, the 10-gallon cooling tank (another old oil drum) being fixed on a small trestle. A petrol and oil tank was made from two one-gallon oil tins, one being cut off about 3 ins. from the bottom and soldered to the bottom of the other, the filler caps were soldered in one side, which then became the top, a tap and drip-feed lubricator being fitted to the opposite side, now the bottom, it was thought to look neater being horizontal rather than vertical when fixed on the wall.

A new switchboard was made out of some four-ply ¼ in. thick, well varnished and mounted on the wall above the plant; it is fitted with a volt-meter, ammeter, two fuses, two single-pole knife switches, a switch for cutting the end cells in or out of circuit, and a mercury cut-out which was made after many trials.

When the battery is fully charged only ten of the twelve cells are connected to the mains, the others being switched in when the battery is partly discharged. The charging rate for these cells is 15 amperes, and as the voltage required is 1.8 each cell, the total output has to be 21-22 volts 15 amperes, or about 330 watts, this is obtained at a speed of 1,100 r.p.m. of the engine, the maximum obtainable being 22 volts 18 amperes.

The plant has now been in use for two winters, the engine running unattended for six or seven hours at a time twice a week, and has given great satisfaction, and has also convinced me that a 12-volt plant is quite a sound proposition. The photograph will be found to show the main details, it being impossible to obtain a better one owing to the smallness of the workshop.

# HISTORY IN MODELS.

**By Frank J. Smith.**

How few of those who walk down the Farringdon Road realise that they are walking over the site of a deep and swift-flowing river, the Fleet, which flowed there centuries before and the estuary of which served, together with Queenhithe and Billingsgate, as the City's only ports in the seventeenth century? Again, how many City men as they travel from Putney to Waterloo realise that practically the whole journey has been made over land which was once the bed of a shallow lagoon some three or four miles in width?

So much has been written of the history of London that everyone should know at least a little of its wonderful past.

The works of Sir Walter Besant, Mr. Gordon Home and others, not to mention novelists like Dickens, have made the citizens of the past live their lives before us again. From such books we have been able to picture the life of the City at different times and to see what particular places looked like, but it is, perhaps, only after continued reading and study that we have been able to visualise the City as a whole or to appreciate at what date the various parts and places grew up. That many old maps exist, showing the City from the sixteenth century onwards is true, but they are drawn in various styles and to divers scales and can rarely be viewed together, so that, in addition to their comparatively recent date, to trace the stages of development with them is difficult.

These were briefly the facts which first suggested to me the making of a set of models showing the City at each stage of its development. It was not, however, until the members of the Polytechnic Association of Surveyors were asked to take a part in the Annual Fête and Exhibition that I gave the idea serious thought.

Then it was, with the help of Mr. R. Broom and other "Poly." friends, that three of the models were made in great haste and exhibited, together with Mr. J. B. Thorp's wonderful model of old London Bridge, and other models and maps in our exhibition, "Old London."

The first model showed the site of London 100 B.C. It is made to a scale of 2 ins. to the mile, and shows the area bounded by Hampstead, Camberwell, Hammersmith and Barking. The wide but shallow Wallbrook separates the twin hills, Cornhill and Ludgate Hill, on which the City stands, their cliff-like sides dipping into the broad lagoon of the Thames, which stretches away to the higher ground of Camberwell, etc. To the north are the fens of Finsbury and Moorgate, and still further north stretch away the primæval forests of Britain. From the heights of Hampstead the Westbourne, Tybourne and Holbourne flow down to the Thames, and from the Surrey heights come the Wandle, Falcon Brook and Ravensbourne. The broad estuary of the Lea protects the hills from attack on the east. One can at a glance appreciate the

advantages that the site offered and can understand why the Celtic people chose the slope of the westerly hill for their home, and its peak for a stronghold.

The second model, which shows only the central portion of the first, but which is constructed to a scale of 6 ins. to the mile, gives an idea of what Roman London was probably like in A.D. 350.

The six great Roman roads are shown, the Vicinal way from Camalodnum (Colchester) enters at Aldgate, the Ermin Street from Lindum (Lincoln) and Eboracum (York) at Bishopsgate, the Watling Street from Deva (Chester) at Newgate, leaving by the bridge for Dover and Richborough, the Roman ports, and, lastly, from Ludgate runs away the great road to the south-west. The Wallbrook still separates the two hills, and the swift-flowing Fleet runs on its west. Among the buildings shown are the Basilica, Temple of Diana, and on the south-west side an amphitheatre.

The last model is a representation of the same area as that of Roman London constructed to the same scale showing London in A.D. 1603. Southwark has grown up and we notice the inns, The Globe Treatre and St. Mary Overies Church. The wall still stands on the three landward sides, and very few buildings have been built outside them.

Dominating the western hill is old St. Paul's, and on the east stands the White Tower. We notice the little villages of Shoreditch and Mile End clustered round their churches, the former connected with the City by a single row of houses on either side of Bishopsgate. The village of Charring is connected with Ludgate by the ill-paved Strand, to the south of which stand the town houses of the nobility, each bearing the name of its owner, such as Durham House, Somerset House, York House, etc. Away in every direction run the great highways to the north, south, east and west, bounded, not by buildings but by green fields and woods. Piccadilly or "The Road to Redinge" without a house, and similarly Oxford Street "on the Road to Uxbridge."

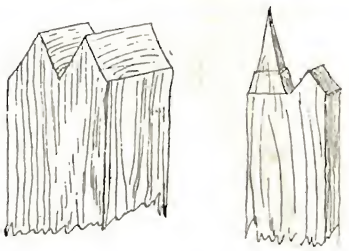
The first step in making these models was to collect the necessary information by comparing maps and books on the subject. The value of the finished model is in direct proportion to the amount of care taken in obtaining these facts. A topographical model which is inaccurate is worthless.

A plan of the contours was then prepared and afterwards detailed maps showing the roads and buildings.

A baseboard somewhat larger than the finished model was constructed of ¾-in. boards on two rails. On this was placed a frame of 2-in. by 2-in. deal halved together at the angles and having the same internal dimensions as the finished model. Into this frame was placed a layer of modelling clay about 1¼ ins. thick. The top surface of this clay was taken as the lowest point in the terrain, in our case the level of the Thames. The distance from the surface of the clay to the top edge of the frame being the height to scale of the river above the datum.

Cross-sections at 2-in. intervals were taken across the contour plan and cut out in plywood, the datum line being the top edge of the wooden frame. These strips, having been placed in position on the clay, were pressed into the proper depth and, when removed, left a number of parallel grooves in the clay varying in depth with the height of the land and to which the clay was subsequently taken out. This gave us a model of the surface of the ground in reverse.

The next step was to lay face downwards a paper tracing of the detailed map on the clay and to trace all the details through. With the aid of small files and other tools, scale models of a section of the City wall and of the various buildings were made on the ends of short pieces of hardwood about ½ in. square. These were pressed into the clay at the proper places and to the appropriate depths. This was probably



**Patterns for Making the Impressions of the Buildings.**

the most delicate operation of all, and called for great patience.

The mould was then ready for the plaster, which was mixed to a thin paste in bowls and poured quickly in and struck off level with the top of the frame.

The day following the mould and cast were laid plaster downwards on to another wooden base the exact size of the model, the mould removed and the cast left for a couple of days to dry out.

When the cast was properly dried a wooden edging was put all round the model from the underside of the base to about an inch above the cast and any small parts which had broken during the taking off of the mould or otherwise were then made good and the whole of the plaster given a coat of size.

Finally, the buildings, fields, rivers and other features were coloured in their natural colours and small labels printed and placed against the principal buildings.

During the next few months it is hoped to complete the set with models of Saxon, Norman, seventeenth century, eighteenth century and nineteenth century London.

# WORKSHOP TOPICS

## Some Notes on Clockmaking—IV.

### By Geo. Gentry.

**Intended to assist model engineers with a liking for clock-making rather than practical horologists who happen to be model engineers.**

(*Continued from page* 280.)

**The Pulleys.**

Fig. 9, numbered, in four details, gives working particulars of a pulley, a pair of which will be required. It consists, as in No. 1, of a 1¾-in. Outside diameter pulley, 1 9/16th-in. working diameter in groove, which groove is not a vee, but a half-round hollow with sloping sides, to take the gut line. The pulley is finished 5/32nd in. wide on rim, and has ⅜-in. diameter equal-sided centre bosses finished 17/64th in. over faces. Turned bright all over, and hollowed beneath rim to 1/16th in. thickness. The bore is 3/16th in. running fit. The pulley runs on the pin of a stirrup (although this is not known in horology as a stirrup, the name being specifically applied to the frame carrying the mercury jars or jars of a mercurial pendulum) used upside down. The stirrup is really a shackle, with a permanently placed pin, which the older clockmakers all made as a double-ended shouldered rivet, flush riveted on the outsides of the bosses of the U-shaped shackle. The pins were usually too small, and resulted in quite rapid wear in the pulley bore and on the pin due to the dead weight always being on; and the bad fit resulting in a drainage of oil. In respect of this fitting only, Mr. Pickering has pointed out more than once to the writer that it is every bit as important an action as any other in the going movement, and that it should be similarly carefully fitted and maintained.

As shown in the drawing, it is arranged in a manner adopted by the writer in all the clocks he has repaired or restored. The shackle should be procurable in the trade as a straight forging. That is, two discs of mild steel about ½ in. diameter by about ⅛ in. thick connected in a straight line and in the same plane by a length of 14 S.W.G. mild steel wire which is spot welded to each disc. The distance apart of the two discs measured straight from centre to centre should be about 3 5/16th ins. The discs are first filed flat on each side, and to parallel thickness of 5/64th in., and finished round the edges to about 7/16th in. diameter. One is then centrally drilled, or drilled and reamered, 3/16th in. clear, and the other drilled ⅛ in., or No. 5 B.A. clearing. The centre of the wire is then heated to dull red, and it is bent centrally around a 9/32nd-in. pin in a plane at right angles to the bossed ends, bringing the two bosses round facing each other concentrically, and there carefully set co-axial and parallel to each other when 9/32nd in. apart. That so far completes the shackle, which should be finished bright all over, and tend to spring outward of the 9/32nd

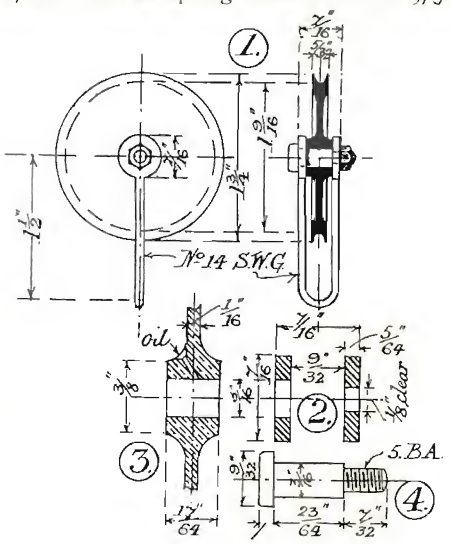



Fig. 9.—Detail of Pulley and Shackle.

in. apart, rather than inward. See detail No. 2 for the relative positions of the bosses.

The pin No. 4 is made of annealed cast steel, preferably from 9/32nd-in. pinion steel wire, or pinion wire with the teeth turned off, rather than from silver steel, which, due to its rolling, turns with a tendency to form elongated pockets. Mr. Geo. Adams has dilated at some length on this feature of silver steel, and does not believe in it as a suitable material for turned spindles. Set up the wire in a chuck and turn to the dimensions given, making the head about 5/64th in. thick (dimension omitted). The screw is cut with a die, and its thread need not go right up to the shoulder. The boss of pulley, seen in section at No. 3, is made 1/64th in. less

in width than the distance apart of the shackle bosses when pinned up. This is the first instance of what is called in clockwork end-shake. While every action in a clock should be quite free from side-shake, every one must have end-shake, and should never be able to bear on both pivot shoulders at once. As seen in the section of No. 1, the steel turned pin, turned a nice running fit in the pulley bore, is put through the larger holed boss of shackle, then through the pulley, and shoulders up against the inner face of the smaller holed boss, which takes the screw. A hexagon nut, put on the screw outside, draws the pin tightly to this shoulder, and the spring of the shackle keeps the other boss out against the head. As seen in No. 3, there should be a tiny oil hole, drilled sloping from the curve of one boss of pulley into the bore, and made with a cup-shaped inlet. No. 56 drill, or less, will do. The idea is that capillarity will hold the oil in the hole, while it will be possible to inject oil from a press-feed oil-can having a fine outlet. It will be necessary, however, to wipe off all superfluous oil from the vicinity of this oil opening, otherwise draining will take place due to syphoning action of the oil drops outside.

Turn the pulley from a casting. If this be of gunmetal, so well and good. If of brass, bore it at least to 5/16th in. and sweat in a gunmetal bush, and bore this a running fit. The bore is a thought too small to turn the rim on a centred mandrel, therefore, the castings should be made with a ½-in. chucking piece projecting about ¾ in. from one side. Put this chucking piece in a s.c. chuck (drill jaws) and see how the wheel runs. If too much out, correct as follows: Put the "lathe" jaws in chuck, and hold the wheel by its rim set back against jaw faces, and with chucking piece outward. True up chucking piece by skimming parallel. Now dechuck, put back drill jaws, and again chuck by chucking piece. Chuck will be too badly out if this doesn't answer. In this chucking, skim up boss, chip out centre, drill down full thickness of wheel with 11/64th in. drill, and bore with a fine internal turning tool till 3/16th-in. hand reamer just enters. Turn rim to size, face up front web and turn rim on inside edge to 5/32nd in. width. Follow by turning groove, using a hand-turning round nose. Take wheel out of chuck, saw off the chucking piece and put back in lathe jaws, unfinished side outward, and holding job very lightly. Chuck right back against jaw faces, and, taking light cuts, face up the web of wheel and other side of boss. Face the boss side and side about till it measures 17/64th in. thickness with the wheel centrally placed. Then open out the centre bore with the hand reamer, doing the job by hand, and carefully; and finally drill the oil hole. The pivot pin should be turned after to fit the wheel an exact running fit.

With reference to the open S-hook shown closed on the shackle in No. 1 Fig. 8. Make this of mild steel or wrought-iron wire No. 14 or 12 S.W.G. Bend it hot and close it cold on to the shackle.

## PICKLING TO REMOVE FLUX AFTER HARD SOLDERING.

Reference is made at times to the advisability of pickling model work which has been hard-soldered. Around the joints of work which has been hard-soldered there is usually formed an apparently immovable glass-like coating of fused borax. To get rid of the latter, dilute sulphuric acid is recommended as a solvent.

Any old acid will do for this, such as discarded battery acid, but it should be fairly up to strength, or it will take a tedious time to loosen the deposit of flux. The strength should be from about 10 per cent., or one of concentrated acid to nine of water, as measured in a graduated glass, having a specific gravity, as measured by an ordinary battery hydrometer, of 1.085, up to one of acid to six of water of specific gravity 1.12.

It is a waste to buy fresh acid and distilled water ready mixed such as used in accumulators, but if fresh acid only be procured, dilute with ordinary water, and be careful to add the acid slowly to the water, and on no account the water to the acid. The mixing should be done in a glazed stoneware pot rather than glass, as it gets hot and may crack glass. Concentrated acid alone will be very nearly inactive.

Accumulator acid which has become contaminated with copper and tin salts from corroded terminals, getting thereby a blue tinge when clear, is usually thrown away, and, no doubt, some of this, of the strength given, could be purchased from a garage or general electrical shop where they lay out to charge motor-car and wireless accumulators. The acid taken from an old battery will do, provided the battery is not in a badly sulphated condition.

Having the old acid, or new, of the strength given, pour some on to the joint and allow to stand, taking care not to spill it on wood of the table or floor, and also keep it off one's fingers. When it has soaked for, say, a quarter of an hour or twenty minutes, try the effect of scraping off the flux. If it is still immovable, leave the job in the acid longer. As soon as the flux loosens, say, on the point of a piece of hardwood or bone, pour away acid, wash with water, and brush away the loose flux with a hard brush such as a file card or similar hard bristle or wire brush. When every vestige of the flux has gone wash the job thoroughly in clean water to be sure of removal of all acid, which, if retained, might attack the metal of the joint during use.

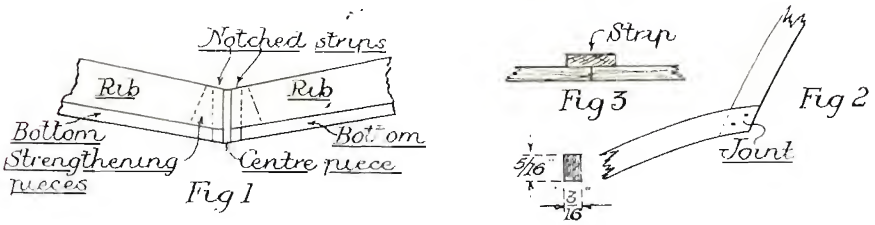
# MODEL MARINE NOTES

## Speed Boat Construction.

### By Jim Thom (of Edmonton, Canada).

The two photographs illustrate the hull of my recently completed racing motor boat of the one-metre class. The design was taken from the article by Mr. E. W. Hobbs, page 787, in "Wonderful Models." Although Mr. Hobbs gives two excellent methods of construction in his article, both require a considerable expenditure of time for their completion. This, of course, depends on the skill and speed of the workman. The variation in the hull construction will be noticed under the heading of "Planking."

Side View of Completed Hull of Racing Boat.




Details of Construction of Hull.

**Points in the Construction.**

The keel was built up of five separate pieces The centre unit ran the length of the keel, *i.e.*, from stem to step and from step to stern. Strips

Plan View showing Interior of Hull.

were then notched to fit the ribs and glued on each side of the centre. After the ribs had been secured in position, small pieces of wood triangular in section and several inches long were cut and glued into place, as shown in Fig. 1. Small nails were used to bind the whole unit together, thus resulting in a strong, solid mass which could not warp or split.

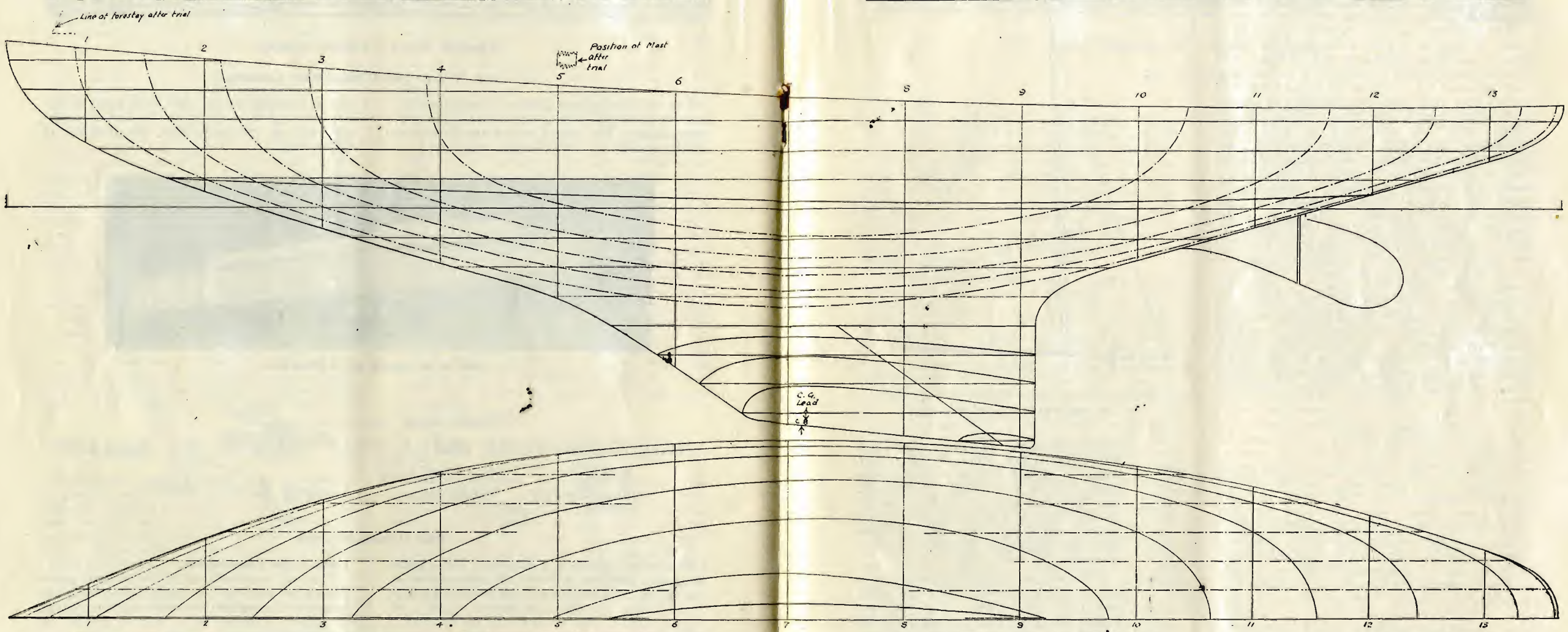


**Ribs.**

The ribs were made in two sections, being glued, riveted and pinned at the joint, as Fig. 2.

**The Stem Head.**

This presented a little difficulty, but by moulding a Plasticine model and fitting it to the skeleton, a very close approximation of the real




*For description*]

## SHEER AND HALF BREADTH PLANS OF SIX-METRE

**(Drawings reproduced above are quarter full size of model.)**

**Rating Particulars.**

| | |
|---|---|
| Measured length ... ... ... | 40 ins. |
| Bow tax 1.5 (11.4 − .9) ... ... | 3.6 ins. |
| Stern tax ¼ (10.8 − 5.9) ... ... | 1.63 ins. |
| Girth tax ¼ (26.8 − 7.5) ... ... | 4.82 ins. |
| "2*d*" tax ... ... ... ... | .4 ins. |
| Sail Area 1,268 sq ins. √S ... ... | 35.61 ins. |
| Sum ... ... ... ... | 86.06 ins. |
| Deduct freeboard ⅛(5 + 3.75 + 3.45) | 4.06 ins. |
| | 82 .00 ins. |

## MODEL YACHT 1⅝ INS. TO THE FOOT.

**quarter full size of model.)**

| | |
|---|---|
| Length overall ... ... ... | 53.12 ins. |
| Load waterline ... ... ... | 36.55 ins. |
| Beam (maximum) ... ... ... | 12.4 ins. |
| Beam (L.W.L.) ... ... ... | 11.30 ins. |
| Draught ... ... ... ... | 8.2 ins. |
| Displacement ... ... ... ... | 20.8 lbs. |
| Lead keel as drawn ... ... ... | 14.2 lbs. |
| Quarter beam length ... ... ... | 36.9 ins. |

Maximum displacement allowed =

$$\left(\frac{\text{L.W.L.}}{5} + .83\right)^3 \times \frac{1}{27.7} = 19.45 \text{ lbs.}$$

Maximum draught allowed =

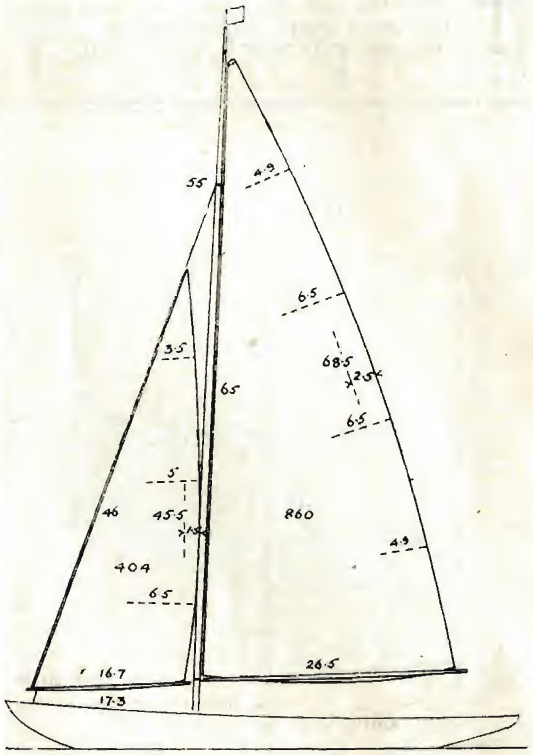
16 L.W.L. + 2.73 = 8.57 ins.

[*see last week's issue.*

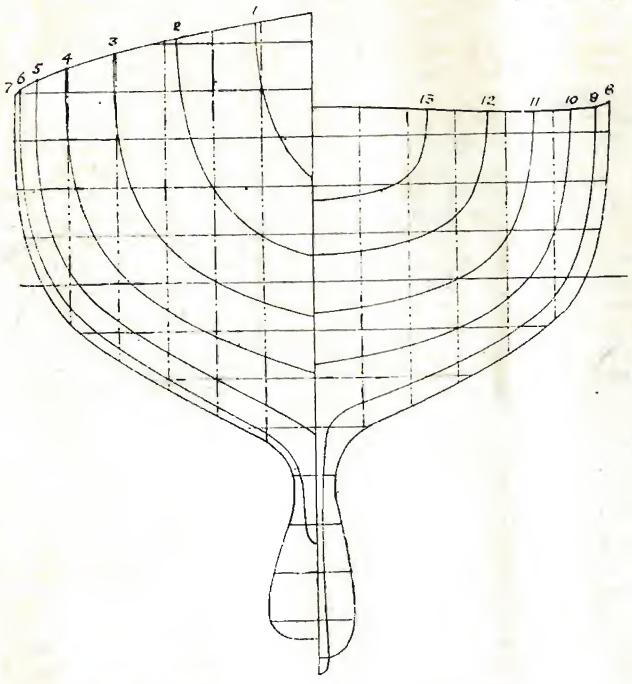
thing was obtained. The stem head proper was then chiselled from the solid, glued and nailed into place. The step and stern were not difficult, just a little bit of neat "wood butchering," and the thing was done.

**Planking.**

The problem was this: to make one layer of wood do and to employ such wood as would give a maximum thickness and strength with just enough pliability to enable it to be bent over the ribs while dry. The ability to put the planks on dry does away with any possibility of shrinkage which might take place should they be steam bent. It also saves a little time. Mahogany was finally decided upon and used. Incidentally, this problem was settled before the boat was started on, so that the structure is made of mahogany throughout. White pine is good, but shows a tendency to split if the nails are placed close together. Mahogany is also slightly lighter than the pine. The bottom of the hydroplane from step to stern was not built by laying panks, but by fitting two sheets of wood on either side of the keel. These were strengthened inside by strips of wood laid diagonally and glued into place (see photo). In the rest of the hull the cracks resulting from the joint of the planks were filled with wood filler and then covered on the inside with another strip of wood. These strips can be seen in the photo with strengthening cross strips between them at equal intervals (Fig. 3), along the bottom and sides. The inside of the hull was given three coats of light grey lacquer. A new feature of this hydroplane will be two airtight bulkheads, one fore and one aft (not shown in photo). They will be placed as indicated by the arrows, and are expected to keep her afloat should she for some reason or other ship too much water.




**Sal Plan of 1¾-in. Six-metre Model Yacht.**




**Body Plan of 1¾-in. Six Metre Reproduced quarter full size of model.**
*(For description see last week's issue.)*

Over here we haven't any ponds that we can wade into and rescue our little boat from the bottom. The boat has passed the acid test of Fred Pollock's critical eye and was pronounced seaworthy. The pictures were taken by Mr. Pye, a MODEL ENGINEER enthusiast who is at present working on a model horizontal steam engine.

Thickness of hydroplane's planks = 3/32nd in.

Weight as pictured in elevation = 2¾ lbs.

So here's hoping to hear from others who are building this same hydroplane.

[We shall be glad to hear from readers who are building this model, and to put them in touch with Mr. Thom if they so wish.—Ed.]

# SHOPS, SHED & ROAD

## A Column of "Live Steam."

### By "L.B.S.C."

**Not Guilty!**

With the exception of a few sample fittings and patterns passed over to Hamleys and Mr. Kennion, *I have done no locomotive work whatever for any trade firm during the past five and a half years.* Anybody offering parts for sale, as being of my make, must have been raking around our domestic ashbarrel for oddments thrown away. Neither am I selling out. Wherever I go, my kit goes with me; we are too old friends to part. 'Nuff sed!

**Here's another of 'em!**

I have often remarked what a pity it is that some good folk insist on rushing into print before ascertaining the facts of the case. A case in point is our friend who signs himself "Little End" on page 235, March 7th issue. Rather an unfortunate pen-name, that; the little end is apparently running hot, so we had better see about cooling it down a bit. Let's analyse.

Spoiling "cylinder castings at eighteen-and-six per pair." Well, I guess anyone who did that would be some kite. "Little End" apparently reads a few of these notes and skips the rest. Has he never heard of my munition girls who "tried out" on scrap pieces before tackling the actual job? Also, if he studied the advertisements, he would learn that the firm who advertised castings at the price he quotes *include all materials and screws, and pay the carriage.*

It is ridiculous to compare the marketing of locomotive castings and parts with "Tin Lizzies and Dustbin Sevens." Our house is on the main London-Brighton road, and on Sundays there are hundreds of cheap cars passing in an endless stream. About 1 per cent. of the owner-drivers *might* know what pushes a steam piston up and down the cylinder. I maintain a car in running order for a tradesman friend in return for "per contra" services; he has driven it *sixty thousand miles*, and is yet mechanically ignorant. Locomotive cylinder castings at one penny per pair would be ignored by him. Locomotive castings are not wanted by "the masses"; automobiles are. Once again, 'Nuff sed!

Where in the world did "Little End" rake up the idea that I had a power-driven workshop? I just haven't, unfortunately, or I might get a bigger output. The N.L. shop, or monkey-gland store, or whatever you like to call it, was intended for a kiddies' bedroom, and measures just twelve feet by eight. Some cavern! It contains a Milnes pedal lathe, a Greenwood stand with pedal carrying an Adams' 2½-in. precision lathe, and a cheap Continental drill-press, the latter driven by an auxiliary pedal and flywheel purchased from our old friend Mr. Conybeare of parrot fame. I described the drive in back notes, which "Little End" overlooked. A bracket by the door carries a pedal-driven grinding head and a hand-driven bench driller, with auto feed. There are two workbenches; one carries a large and small vice, and I call it the "fitting shop." On the other is a Firth hand-driven planer and a small lever shearing-machine, located at opposite ends. The space between is my "erecting shop." Around the walls of the room are shelves, mostly home-made from broken packing cases and the like, and these carry numerous tobacco tins (evidence of how my late next-door neighbour's spare cash went in smoke!) and spark plug boxes containing screws, odd parts and various oddments. "Hospital sidings" consists of a discarded store fitting, which has three long shelves and a few pigeon-holes. Here may be seen locomotives awaiting their turn, and others ready to go away. By the time your humble servant gets inside this palace of varieties, there isn't much room for anything else; not even my miller, which adorns the "cubby-hole" or lumber room. Henry Ford once said that for maximum efficiency a man should not take more than four steps to change tools, machines, or operations. I can beat him to a frazzle—two steps are enough for me. The only source of "power" is my own physical energy.

Re prices. It is a peculiar coincidence that five hundred hours at two shillings per hour, plus ten pounds for materials and other outgoings, was exactly my own computation of the charge for a "one-off" specially built 2½-in. gauge locomotive without frills nor extras. IF I was certain of that hourly rate *for every hour I worked*, I would be satisfied; an engine-driver's pay is 15s. per 8-hour day. BUT—there are little matters of correspondence, telephone calls, visitors, etc., which all take time and are non-productive. That is what upsets the bread-and-butter business, and "Little End" ignores such items. The maximum number of letters I answered in one week was fifty-three, many of the writers requiring information for their own

special jobs, and some not even paying return postage. Taking on an average, half-hour each answer, there is over half a working week gone and not a farthing to show for it. Well, brothers all, I only submit that it is d——d hard lines to make sacrifice for "the cause" and then be virtually accused of profiteering!

As to "Little End's" last paragraph, I guess he'd better not cast the cylinders in the kitchen fire (especially if he paid 18s. 6d. for them), they won't be much good afterwards! But, joking apart, even supposing he makes a pattern, moulding box, and moulds; buys materials; uses up all his good lady's coal and burns the black-lead polish off the range, in getting enough heat to melt the metal; makes a few wasters, and finally turns out a couple of castings more or less like cylinders and wanting a —— of a lot of machining; when all is reckoned up, I guess he will find it far cheaper to buy a pair even at 18s. 6d. "carriage paid with screws and material." But "Little End" and anyone else who cannot afford that sum, take this advice. Make your own metal pattern to instructions recently given in these notes, and send it to one of the foundrymen advertising in this paper. Price per lb. of small castings varies with weight of pieces, or number of pieces to the pound, also with the nature of pattern. Some take a dickens of a trouble to mould. If I send patterns direct to a foundry, they charge anything between 1s. 6d. and 2s. per pound for good gunmetal and bronze, taking about ten pounds at one order. I hope the information will be useful, and wish "Little End" the best of luck.

**"Fayette's" Boiler—continued.**

The next job is the backhead. Lay the former plate on a piece of 13-gauge copper, and mark out a piece ¼ in. larger all around except at bottom. Cut out, well anneal, and flange the edges over the former plate. Drill holes as shown in sketch, and clean up the flange with a rough-cut file. To get location of firehole, measure from top of firehole ring in partly assembled boiler to top of wrapper plate; transfer this measurement to the backhead, and, with that as a guide, mark outline of hole. Drill a ring of holes inside the marking, break the piece out, file up, but leave the hole undersize and try the plate in position. You can then see where to enlarge the hole to get a correct snug fit for the projecting lip of the firehole ring. Then put the backhead in "for keeps" and carefully hammer down the projecting lip of the firehole ring, having well cleaned the edges. This can best be done by resting the boiler on a piece of bar held in the vice, the bar going into the firebox to act as "holder-up." Next, bed the wrapper well down on the file-scratched edges of the backhead; don't hit too hard and distort the whole bag of tricks. Secure in position for brazing by a few 7 B.A. countersunk brass screws driven through the wrapper into the backhead flange. Use a little "Houghtolard" or other cutting compound when drilling and tapping soft copper, it prevents any tearing. Next fit the three remaining sides of the foundation or mud-ring. These are 3/16th-in. square soft copper rod; either three separate lengths, or one bent to shape as you prefer. Clean up, and rivet in place with 3/32nd-in. roundhead copper rivets at ⅜-in. centres. Countersink on outside for neatness' sake, and before putting together be quite certain that all the parts are clean and bright. A little Boron compo paste may be smeared over all surfaces to be brazed before joining them up; it will help the spelter to run. All bushes may now be fitted; the sketch gives those on the backhead. On top of the boiler there are six all told. One at 3 ins. from front, tapped ⅜ in. to take top-feed delivery fitting. Another, 1 in. diameter with ⅝-in. hole in it, for dome cover, 4 ins. behind the first. One, tapped ¼ in., close to backhead, for whistle turret; another ditto 1 in. in advance of it for steam and water gauge connections. Two tapped ⅜ in. for safety valves, the rearmost 3 ins. from back end of boiler or at any other point you might fancy. The safety valves on the original "Fay." are genuine "pop" type and set 1 in. between centres.

**The Final Braze Up.**

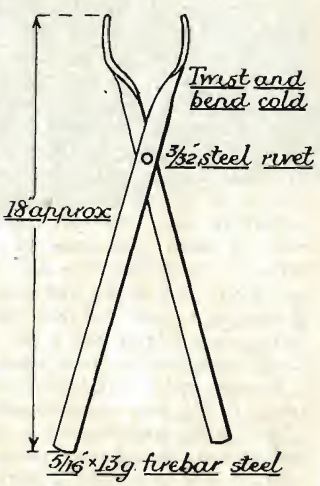
The boiler is now ready for the cold-weather job; and the best time and place is evening and garden. If you will take a tip, never under any circumstances do brazing jobs in your workshop, nor even solder there if you can find somewhere else to carry out such work. Coke and acid fumes attack bright tools and machinery almost instantly; you will find a layer of rust over them almost before the job is through. Even in a big place such as a garage repair shop where one "department" has to serve for jobs of all kinds, the forge should be kept in a well-ventilated place as far away from the tools and machinery as possible. Another point is very important: a big blowlamp or kerosene torch is a source of danger indoors. Whilst brazing up the boiler shell of Mr. Adams' wagon-top N.P. 4—4—0, the vaporiser of my five-pint "Barthel" burst and shot out a white flame, 3 ft. long, across the handles of the shut-off valve and air release. I was operating indoors, on account of rain, and had about the liveliest two-minutes' excitement I ever had during the course of a troubled life.

Well, first cover *all* the joints with Boron paste; set the boiler "bottom-up" among the coke, pack all around to the level of the foundation ring, stuff some asbestos inside the firebox to protect the combustion chamber, and get the lamp or blowpipe going good and strong. Have some strips of silver-solder handy and some easy-running brazing strip, also a pointed scratching wire, and a little pair of tongs for holding silver-solder. You can make these in five minutes out of two 18-in. lengths of firebar steel and a 3/32nd-in. steel rivet. Direct the flame all

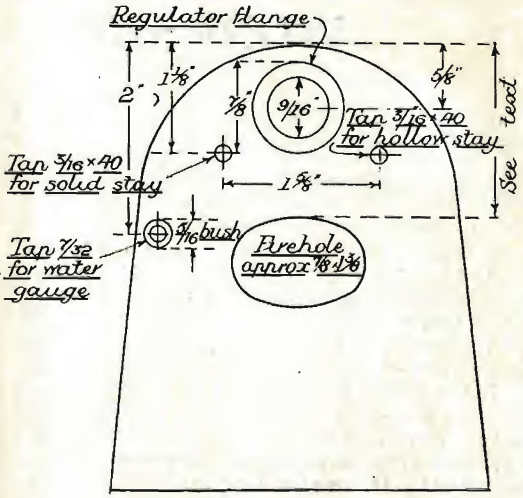
around the foundation ring until it glows dull red all over, and the compo fuses; then apply a little silver-solder which will melt and run in the cracks. Blow a little harder, to bright red, then apply spelter or brazing strip; and when this melts also and runs, use the scratch wire, poking well around the corners. You can easily see whether the silver-solder and spelter has "taken" or not, without my explaining how! Let it go black; then up-end the boiler and have a go at the backhead. I used to do this before the ring; but found that by doing the latter first, any surplus spelter runs down into the backhead joint and the job has "half done itself," in a manner of speaking, before you turn the boiler on end. The layer of Boron compo over the seams will have prevented oxidation at the first heat, so all you do now is to blow up red with the flame again, and repeat the performance with silver-solder and spelter. Do not spelter the bushes; silver-solder alone is O.K. there. Finally, turn the boiler right way up, and, if the flame is directed straight on to each top bush, it will be possible to get enough local heat at each point to silver-solder the bushes without interfering with the rest of the joints. Let it all go black again; then carefully pick up the whole gadget with the big tongs—don't squeeze hard or it will dent—and carefully examine for any missed places or pinholes. They can usually be spotted, as the spelter shows up bright against the blackened copper. If satisfied, put the boiler in a pickle bath and hold a sheet of newspaper or some other shield between yourself and the ducking operation, otherwise you'll suddenly find your overall or clothes going as full of holes as the domestic colander. Wash well in running water after about half-an-hour in the bath. Scrape off any undissolved burnt compo and scour up the whole lot with emery-cloth, bath brick and paraffin.

**Staying the Firebox and Barrel.**

There is no need for a lengthy dissertation on this simple job. Just drill a series of holes with No. 40 drill at ¾-in. centres all over the firebox sides; two extra in the front of throat-plate between barrel and foundation ring, and three in the backhead under firehole. Tap them all 5 B.A. and either put in roundhead brass




**Tongs made in Five Minutes.**




**"Fayette": Backhead.**

screws, with heads outside and locknuts inside the box, or else screw in pieces of phosphor-bronze wire and either locknut or rivet over inside and out. If you leave the threads a very tight fit, a taste of red-lead paste under the nuts will keep them free from leakage when the fire is alight and the boiler is at maximum expansion. If there is any doubt, however, slop a dose of Baker's fluid over heads and nuts, and sweat in some solder or high-melting babbit with a blowlamp, just to act as a caulking and stop up cracks.

There are two longitudinal or barrel stays: one 3/16th-in. solid rod, brass will do but bronze is better; and one 3/16th-in. by 16-gauge copper tube to carry steam for blower. I have described very often in back notes how to fix these; they screw through the backhead, and are fixed in the smokebox tubeplate by hexagon-headed nipples threaded internally and externally same pitch —3/16th-in. by 40 inside, ¼-in. by 40 outside, smokebox tubeplate being tapped to suit. No solder needed over nipples if threads are tight. Put a locknut over backhead end of solid stay; the blower valve fits over the end of hollow one. The boiler can now be hydraulically tested. Block up all the holes except one and attach a pump to that, an ordinary tender pump will do, if a long lever is fitted, and a pressure gauge attached. If you can put 200 lbs. in without anything "busting," the boiler will serve. If the crown sheet moves slightly, say, 1/32nd in. or so, and remains like it, take no notice. With plate staying, the flanges are sometimes not pulled up tightly against the plate and the whole issue "takes up the slack" under pressure. With direct staying, the plate bulges between the stays and is more likely to give out. If all O.K., the next job will be boiler fittings—interesting work.

# WORKSHOP ARITHMETIC.

By C. D. M.

It is very often possible to shorten calculations quite a lot by adopting a few "dodges," and I shall try to show how useful one particular class of dodge is in what follows.

To begin with, we must just say a few words on errors. "Every fourth form boy knows," as Macaulay would have said, that an error which may be important in one case is negligible in another. For instance, an error of a thousandth of an inch is very little in a 6-in. shaft but would be important in a watch pivot. It is not the size of the error but the proportion that the error is of the total amount that matters. This proportion may very well be expressed as a percentage. If a length which should be 20 ins. is 21 ins., the error is 1 in. in 20 ins., *i.e.*, 5 in 100, or 5 per cent. of the whole. Similarly, if a nominal $\frac{1}{2}$ in. is really 0.525 in., the error is again 5 per cent. of the whole, and both errors are equally important, other things being equal.

Now for rule (1), which you will have to take on trust:—

(1) When several numbers are multiplied together, if one number has a certain percentage error, this will cause the *same* percentage error in the result.

Suppose you have this sum to work out:—

$$20.1 \times 5.7 \times 9.9$$

Call it, for the moment, $20 \times 6 \times 10$, which will be something near. This comes to 1,200. Now to get a better result we must increase 20 to its proper value 20.1. This is an increase of 0.1 in 20, *i.e.*, 1 in 200 = $\frac{1}{2}$ per cent. This error of $\frac{1}{2}$ per cent. must, by rule (1), have caused an error of $\frac{1}{2}$ per cent. in the result, and we must increase it by that amount. The error *in* the result is $\frac{1}{2}$ per cent. *of* the result, notice. Similarly, we have made an error of 5 per cent. in the second factor, but this time *the other way*—we have taken it too large, and must *decrease* the result by 5 per cent. on that account. For the third factor, which again was taken too large, 10 instead of 9.9, we must decrease the result by 1 per cent.

(2) If the errors due to the factors separately are small, we can get the total error in the result by simply adding (or, if necessary, subtracting) them.

Thus, the above result has to be decreased by 5 per cent. and 1 per cent. and increased by $\frac{1}{2}$ per cent., giving a net decrease of $5\frac{1}{2}$ per cent. How much does this come to?

$5\frac{1}{2}$ per cent. of 1,200 is $\frac{5\frac{1}{2}}{100}$ of 1,200, *i.e.*, $\frac{11}{200}$

$$\times 1{,}200 = 66.$$

Decreasing the result, 1,200, by this we get 1,134 as a corrected answer. As a matter of fact, the exact answer is 1,134.243, but it's very seldom you need more than four figures in workshop calculations.

The corrected result is still not quite exact and that is why the errors must be small to reduce the final error to as little as possible. In general, errors should not be more than 5 per cent., although up to 10 per cent. or so could be allowed with fair accuracy.

This will seem a long rigmarole, but that is due to every step being explained fully, and in any case there is not much brain strain. I would advise anyone *not* to learn it by rote but to get the idea of it.

The principle is much more useful in division.

(3) In dividing by a number, an error in it will cause the same percentage error in the result but in the reverse direction.

As an example, what size is a 4 mm. drill as a decimal of an inch?

25.4 mm. = 1 in., so that 4 mm. = $\frac{4}{25.4}$ in.

To divide by 25.4 would be a great nuisance, but, noticing that it is roughly 25, we can get round it thus:—

$$\frac{4}{25.4} = \frac{160}{1{,}016}$$

For a first guess, call it $\frac{160}{1{,}000}$ = 0.16000. Then we have to make the denominator 1,016 for greater accuracy, *i.e.*, make an increase of 1.6 per cent. Obviously, this makes the answer smaller (hence "reverse direction" in rule 3), and smaller by 1.6 per cent. The correction comes out at 0.00256, so the final answer is 0.16000 − 0.00256 = 0.15744 in. The true value is 0.15748 in.

The great advantage of this is that it can be done mentally. I have a "Columbus" slide gauge, measuring 1/16ths in. with vernier to 1/128ths in. on one side, and millimetres with vernier to 1/10th mm. on the other. Instead of bothering with sixteenths and all the rest of it, when I want a decimal of an inch I regularly measure in millimetres and convert into inches mentally. In doing the sum mentally, it is a good plan to subtract first 1 per cent., then $\frac{1}{2}$ per cent., then 1/10th per cent. All these are easy to get and total up to 1.6 per cent.

It does not seem to have been much noticed that 1/256th in. = 1/10th mm. = 4 thousandths of an inch, approximately. Thus, a 7/64th-in. drill is roughly 2.8 mm. or 0.112 in.

We can extend the general principle further, thus:—

(4) In squaring a number the percentage error is doubled, in cubing trebled, and so on. On the other hand, in finding square roots it is halved, for cube roots divided by three, etc.

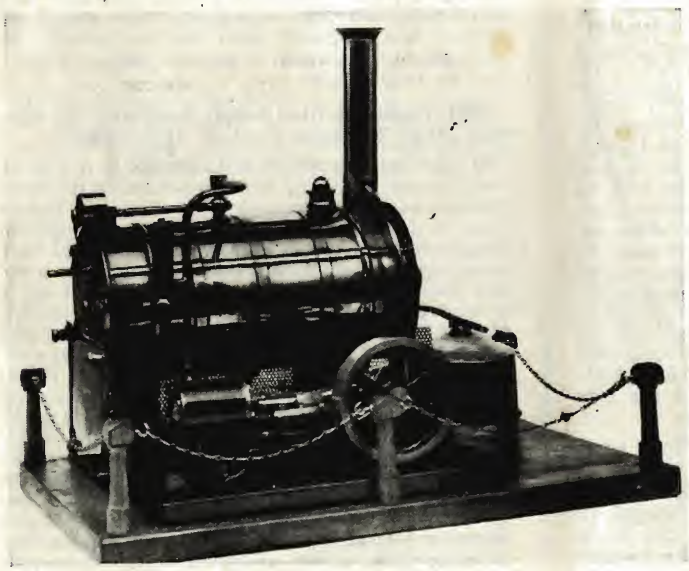
This may be useful to model yachtsmen who have to find square roots in rating rules. For an example, find the square root of 10. Taking it as 9, $\sqrt{9} = 3$, is a rough result. Now, we have to increase the original number by 1 in 9 to make it right, *i.e.*, by 11 per cent. Thus the answer by rule (4) must be increased by $\frac{11}{2}$ per cent. = $5\frac{1}{2}$ per cent.; $5\frac{1}{2}$ per cent. of 3 is 0.165, thus corrected answer is 3.165. The correct result is 3.162.

One final thing, use a rough check where possible.

# A LITTLE STEAM SET THAT DRIVES A SEWING MACHINE.

**By C. F. Parker.**

The boiler of this set was made from an old carbide container, found in the scrapbox. Four cross-stays were fixed at equal distances apart, and one stay lengthwise, screwed and bolted at each end. Three copper bands were put round boiler and bolted underneath. These are clearly shown in the photograph.



A Small "Utility" Steam Set.

The chimney was made from a plated tooth-brush case, which I "won" from a grown-up daughter's outfit. Then, not liking the appearance of the straight top, I once again sorted through the scrapbox. This time I found an old bed knob, which, when sawn through, provided the required bell-top well. The remainder of the knob was utilised as a cover for the nut on the boiler front, and can just be seen in the photograph.

The following fittings were then fixed: pressure-gauge, filler cap, steam valve and safety valve. The steam is controlled by the "regulator" at the back end of boiler. This was made from an old gas burner lever, and a quadrant piece for this lever to slide on was fixed, which prevents the lever being pushed over too far. The supports for the boiler were sawn from an old phonograph, which had been derelict for years. Steam is generated by means of a five-burner methylated spirit lamp, these being fed from a container in front; this was also part of the carbide generator.

The engine is a "Stuart," and was bought partly finished from a friend, locally. All the fitting, however, was done by myself, and great care was taken to do the job well. The valve gave the most trouble, and, after a few test runs, had to be again dismantled. The valve rods had been screwed direct into valve and it refused to seat on port face, so I decided to adopt the nut and slot principle. This, after carefully grinding down valve face, also port face, proved absolutely successful. At 20 lbs. boiler pressure the engine could be heard humming. It now runs perfectly. At 30 lbs. pressure the engine will drive a sewing-machine. Cylinder is 1-in. bore and 1-in. stroke.

The whole plant is mounted on base with oak pillars, and has a brass chain around; this gives the model a very nice appearance.

My next job will be to couple up a dynamo to the engine, but have not yet decided what type will be most suitable.

I ask readers not to be too exacting with their criticisms of this set, as my work as a ticket collector on the L.N.E.R. does not bring me into very close touch with mechanical matters.

# QUERIES and REPLIES

**Querists must comply with the Conditions and Rules given with the query Coupon in the Advertisement Page of each issue.**

## Selections from Queries recently replied to.

**3158. Altering Output of 6 K.W. Dynamo.**—T. E. (Gortatlea, Co. Kerry).

**Q.**—I have a 100-volt 60-ampere dynamo (shunt), no maker's name, and have no use for 100 volts or 60 amperes. Can you advise me how to reduce same to about 60 volts 30 to 40 amperes? Would shorting commutator segments or armature windings do it?

**A.**—If it is a machine with a two-pole field magnet wound with two coils, try the following: Connect the two field coils in parallel, that is, break the connection between the two coils and join the two starting ends together and the two finishing ends together. You must be careful to preserve the present polarity of field. Then reduce the armature speed about 40 per cent., that is, not quite one half. The machine may then possibly give about 60 volts. As regards current, this simply depends upon how many amperes you care to draw from the armature. If the machine will not excite at this speed or the voltage is not maintained, increase the speed until the voltage is maintained. Then connect some resistance in the field coil so as to bring the voltage down. Say, about 4 ozs. of No. 20 gauge Eureka or similar resistance wire; adjust the amount as may be required. By these means you may be able to get the voltage down to the amount desired. You could cut out each alternate coil of the armature winding by disconnecting it or cutting through at one place; this would halve the voltage at the present speed with field coils connected in parallel as suggested. But leave the ends of these coils open, otherwise the coils will burn out. You will require to connect adjacent sections of the commutator together so as to reduce the number to one half. You should have sent a sketch of dynamo and particulars of windings.

**3097. Lubricants for Small Cutting Tools, Dies, etc.**—A. G. (Edinburgh).

**Q.**—(1) What kind of oil is usually used for hardening and tempering small tools in one operation? How much oil would be required and can it be easily obtained? (2) Can you recommend a suitable lubricant for screws and working parts of arc lamps (not electrical working parts)? Oil dries up by the heat, and causes the movement of the lamp to become stiff. (3) In the catalogue of taps and dies made by Lehmann, Archer & Co., Ltd., it is stated that oil should not be used in tapping and screwing. It is advised that a cutting compound be used. What is this cutting mixture mentioned by them?

**A.**—Read "Cutting and Quenching Oils," page 26 of THE MODEL ENGINEER of January 10, this year. (1) Whale oil or sperm oil are those generally used, also special quenching oils or compounds supplied by firms specialising in oil and compounds for quenching and cutting purposes. The quantity required depends upon the size of the piece to be quenched or number of pieces immersed at one operation. For single small pieces a pint may be sufficient; there should be ample to effect the cooling. You will have to use your own discretion. (2) We suggest brushing the screws with powdered graphite (blacklead). Alternatively, you might try the mineral oil used for lubricating the cylinders of internal combustion engines. (3) Probably the recommendation mentioned refers to screwing and tapping by automatic and other rapid working machines used in quantity production. For home workshop practice use any lubricating oil, it will serve quite well. Messrs. Edgar Vaughan & Co., Ltd., Legge Street, Birmingham, sell various special compounds for cutting or for quenching, they would no doubt send particulars on receipt of enquiry. We have used some of their compounds and found them to be useful and satisfactory. Lard oil is much use as a lubricant for cutting tools.

**3097. Small Electrical Supply Equipment for Running Model Railway.**—C. P. P. (Llandudno).

**Q.**—I want a supply of D.C. electricity to run an electric train taking 1¼ amperes 6 volts at full load. I have a supply laid on, 230 volts 50 cycles. I don't want to use a chemical rectifier. I had thought of using a dynamo driven by a water motor (we have a very good pressure), but think it might not prove very satisfactory. What I should like would be a small A.C. motor driving a dynamo. I have a copy of THE MODEL ENGINEER Handbook No. 10, and would like to make my motor as No. 5 on page 16, building the field magnet up out of sheet iron. What thickness of sheet iron should I use and what size motor should I need and what should I wind it with? I thought of taking the current from the mains through lamps to prevent the motor running away when the load was removed. I should make the dynamo the same type. I suppose the smallest one would do? Please give suitable windings for an output of 6 volts 1¼ amperes? Do you consider the above scheme suitable or would a water motor be better?

**A.**—We understand that rectified alternating current will operate a model electric railway. You might use a transformer to step down the supply to, say, 50 volts at the rectifier terminals. But we should rather advise you to have a dynamo. With regard to driving it by an alternating current motor we advise you to buy the motor; if you attempt to make one you will have to experiment and then the machine may not work satisfactorily. For the dynamo, we advise a size not less than about 30 watts output capacity, the field magnet should be compound wound. Allow about ⅛ horse-power for driving it. If you do not wish to buy an alternating

current motor, then try a water motor; you can obtain this complete or as a set of castings from Messrs. Whitney, 129, City Road, London, E.C. The amount of water required will depend upon the pressure of the supply. With 40 lbs. pressure ⅛ horse-power will require a flow of about 5½ gallons per minute. You can adjust matters by fitting a nozzle having a suitable diameter of bore. Dynamo should give about 8 to 10 volts, use a regulating resistance between the dynamo and the railway. Take any of the 30-watt size designs given in our Handbook No. 10 and wind the armature with No. 23 gauge D.S.C. copper wire and the field magnet with No. 22 gauge S.C.C. copper wire for a shunt winding, over this wind two layers of No. 18 gauge D.C.C. copper wire for a series winding. Adjust the speed to suit the working of the railway. The armature should be drum pattern, not single coil shuttle pattern. The design shown on page 16 of our book is Fig. 15, we presume this is the one you mean. If you care to try making this design, as an alternating current motor, use the 250-watt size with laminated field magnet; the stampings should be about No. 24 gauge thickness. Wind the armature with No. 26 gauge D.C.C. copper wire and the field magnet with No. 19 gauge S.C.C. copper wire connected in series with the armature as an experiment for working direct from the supply. The brushes must be adjusted to position by trial. Field coils for use with alternating current should not be wound on metal bobbins. If you have the motor and dynamo of very small size, the working results are not likely to be satisfactory.

**3168. Precision Lathes: Makers and Agents.**—W. K. (Kensington).

**Q.**—Would you give me, as a regular reader of THE MODEL ENGINEER, a list of manufacturers of high-class precision lathes of small capacity (2½-in. to 4-in.). I am already well acquainted with the Lorch, Boley, and George Adams' productions, but wish for something like the Rivett 4½-in., but of smaller capacity.

**A.**—You should enquire of the undermentioned firms, all of which are interested in the production of precision lathes for various duties: (1) Buck and Hickman, Ltd., 2-8, Whitechapel Road, E.1.; agents, British and American. (2) Burton, Griffiths and Co., Ltd., 64-70, Vauxhall Bridge Road, S.W.1; agents Starke lathes and others. (3) Chas. Churchill and Co., Ltd., and James Carson & Co., Ltd., 9-15, Leonard Street, Finsbury, E.C.2; *re* Carson lathe. (4) B. Elliott & Co., Ltd., St. Pancras Works, Tileyard Road, York Road, N.7; agents, Leinen lathes (late Boley & Leinen). (5) Farmer, Stedall and Co., Ltd., 145, St. John Street, Clerkenwell, E.C.; agents, J. Lambercier & Co., Geneva, makers. (6) Hjorth Lathe & Tool Co., Woburn, Mass. (respecting this firm, you should enquire all round of agents given). (7) Holbrook & Sons, 44, Martin Street, Stratford, E.; makers. (8) Sidney G. Jones, Ltd., 72-74, Victoria Street, S.W.1; agents, "Mikron" lathes (Swiss of French) (failing this firm, enquire of other agents). (9) R. H. Morse, 26-27, Elden Place, Brighton; maker. (10) Selson Engineering Co., Ltd., 26-28, Charles Street, Hatton Garden, E.C.1.; agents for H.C. precision lathes. (11) Société Genevoise, Ltd., 95, Queen Victoria Street, E.C.4; makers. (12) Vidal Engineering Co., Ltd., Thornton Road, Croydon; makers. (13) Wolf Jahn & Co., Frankfurt; makers of small precision lathes (enquire of Geo. Adams, 292-3, High Holborn, W.C.1).

**3169. Rewinding 120-watt Car-lighting Dynamo to give 200 Watts.**—E. S. (Sandiacre).

**Q.**—I want to rewind a C.A.V. car-lighting dynamo for an output of 25 volts 8 amperes if possible. The machine was previously rated at 12 volts 10 amperes, and I would like to know what gauge and quantity of wire will now be required for the altered outlook.

**A.**—The alteration required entails increasing the output from 120 watts to 200 watts, and this can only be done with a corresponding increase in speed. As a car-lighting dynamo this machine probably ran at obout 1,400 revolutions per minute when giving its full output of 120 watts, in which case a 200-watt output can only be expected by raising the speed to 2,400 revolutions per minute. The armature appears to be a 24-slot drum, 3¼ ins. diameter by 3 ins. long, with a 48-part commutator, but the entire absence of particulars as regards the field magnet makes it somewhat difficult to advise. The generality of car-lighting dynamos have either intermediate poles or third-brush regulation for controlling the output at varying car speeds, and upon the design the specification for rewinding must largely depend. The earlier types of car dynamos of this particular make had four poles, two long pole-pieces carrying the exciting coils and two short unwound poles provided to carry the crossflux from the armature which, by distorting the main field with increased speeds, controlled the output. If this is so in the present case it would be advisable to remove the shorter pole-pieces altogether, leaving the field magnet to function as an ordinary two-pole field, and to wind as a plain shunt dynamo without any self-regulating features whatever. The winding specification suitable for such conditions, and an output of 25 volts 8 amperes at 2,400 revolutions per minute, will then be as follows: armature, 24 double former-wound coils, each containing 6 + 5 = 11 turns of No. 18 S.W.G. D.C.C. copper, coil span from slot 1 to slot 11, commutator span segments 1 to 2. Field winding to consist of two coils, each containing 700 turns of No. 22 S.W.G. S.C.C. copper, the two coils in series with one another and shunt connected to the armature. Only two brushes will be required, the section being about ⅝ in. by 5/16th in., and the grade of carbon being "Link E.G."

**3176. Calcium Tungstate.**—A. J. M. (Muswell Hill, N.).

**Q.**—Can you tell me where I can buy calcium tungstate for fluorescent screens? About how much does it cost?

**A.**—This may be had from Townson & Mercer, Ltd., 34, Camomile Street, London, E.C.3. Price approximately 1s. 2d. per oz., or 14s. per lb.

**3178. Screw Propellers.**—A. B. (Knightsbridge).

**Q.**—Please give dates of any article on screw propellers, showing how to calculate the pitch of screw, etc.

**A.**—See our issues of May 21, 1908, and September 21, 1911.

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**Answers to Correspondents.**

H. D. (Fowey): **Books on Sailmaking.**—The undermentioned books on sailmaking will give you the information you require: "Sailmaking," by Samuel B. Sadler, second edition, revised and enlarged, 12s. 6d., postage 4d. "Sails and Sailmaking," by R. Kipping, 3s. 6d., postage 3d. The latter deals with draughting, the centre of effort of the sails; weights and sizes of ropes; masting, rigging, and sails of steam vessels. Both can be had from our Publishing Department

# PRACTICAL LETTERS from OUR READERS

### Model Locos at the British Industries Fair.

DEAR SIR,—We read with interest your description of models seen at the British Industries Fair, but we think there is one exhibit that you have failed to mention, and that is the very interesting scenic model shown on the stall of Messrs. Imperial Chemical Industries, Ltd. This depicted a section of their very large works, and, incidentally, had two of our "Bonzone" locomotives running in the goods siding.—Yours truly,

for BOND'S O'EUSTON ROAD, LTD.,
E. D. PHILLIPS.

### Some Railway Snaps from Australia.

DEAR SIR,—I am sending you a few photos which you may care to publish in THE MODEL ENGINEER which I think would be of interest to your readers. I am a foundation member of the South Australian Model Engineers. We have been having some good visits to very interesting places in the last twelve months. The photo of the group of model engineers standing by the new mountain-type loco was taken at the Round House at Mile End when we had a

**Model Engineers Inspect a New Mountain-Type Locomotive.**

very interesting visit, the officials of the railway going to much trouble to conduct us through every thing to be seen.

The railways of South Australia have been entirely reorganised in the last five years, the Adelaide Station having been entirely rebuilt. The other two photos show the Adelaide to Melbourne express leaving the old station double-headed by two R.X. class locos to take it through the hills to Serviceton, where they are changed to the Victorian engine, the other picture shows the express leaving with one of the new mountain type. These locos pull the train of eight cars and brake-van through unaided and reduce the time by an hour, the grade is 1 in 45 in many places.

I am pleased to say the society is going strong and has about 80 members. I am building the gauge 0 Atlantic described by "L.B.S.C." in the "Live Steam" column of your paper some time ago. I will send you some photos when I get her together. I am a regular reader of THE MODEL ENGINEER; it is a most interesting and helpful paper. We have much difficulty in obtaining supplies of model stuff. After reading your advertisements, I wish I were a bit closer to England. I trust this will be of interest to you, wishing your paper every success.—Yours faithfully,

C. MILLER.

South Australia.

**The Adelaide-Melbourne Express leaving the Old Station Double-headed.**

### The Model Maker's Craft.

SIR,—It is but seldom that I participate in the controversies in THE MODEL ENGINEER—I am too busy trying to make a living out of model building—but there is a remark in "Little End's" letter in March 7 issue which I take exception to as it is aimed at "L.B.S.C.," a gentleman for whom I have the greatest admiration (although unknown personally to me).

"Little End" remarks: "We will give him, say, 2s. an hour, good bread and butter pay that."

Does "Little End" *seriously* consider that 2s. an

**A New Mountain-Type leaving with an Express.**

hour is good pay for a man of "L.B.S.C.'s" skill and knowledge?

Does "Little End" realise that—to turn out work like "L.B.S.C." does—he must have the skill and knowledge of the finest mechanic in any large engineering shop? Would a head engineer be satisfied with 2s. an hour? There is any amount of *unskilled* labour drawing £4 per week.

I fear that our friend "Little End" is but another of that large army who talk without any *real* knowledge of their subject. He has not the remotest idea of the amount of work and skill there is in the turning out of a real model coal-fired passenger-hauling locomotive, there can be no "near enough" work in a machine of this class.

I am no arm-chair critic, I speak from *experience*. I have been building models for a living (or trying to) for the last twenty-five years, and I can tell "Little End" quite candidly that if "L.B.S.C." builds a model of a modern locomotive (such as *he* turns out) for £60, he is not likely to become the owner of a Rolls Royce for many years to come! It is only too obvious that "Little End" has no experience of such a job or he would not challenge the figure.

I may mention that I have just been asked to quote for the finished parts for a 2½-in. gauge Pacific—finished cylinders with piston valves and full Walschaerts gear, finished wheels, frames, fittings and finished coal-fired boiler, unlagged, tested to 175 lbs., and I have quoted approximately £45. I do not suppose that I shall secure this order; it will be considered too dear. On the other hand, I shall not at all mind if I don't!

Has it ever struck "Little End" *why* there are so few firms catering for his requirements? It is because he, together with many others, expect to buy their materials at a price which would not give the producers a living.

I suggest that "Little End" builds a 2½-in. gauge model locomotive. I do not mean a *monstrosity*, I refer to a real miniature locomotive to the high standard of "L.B.S.C." (he will, by the way, find it takes him *far* more than 50 per cent. longer!), and when he has finished I think we shall have him coming to "L.B.S.C." with his tail between his legs and asking him however he can build one for £60!

In conclusion, I would point out that these beautiful examples of work are not *mass production* jobs and never can be, they are an expression of the builder's character and aspirations; as they grow they seem to become *part* of him—*a living thing*—and for my part I am not ashamed to admit that on several occasions I have been conscious of a nasty choking feeling in the throat when the finished model has been lowered into its case.—Yours faithfully,

EDWARD H. MEERS.

Canterbury.

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### Those Strong and Simple Lathes.

DEAR SIR,—I duly noted Mr. Dillon's letter in the January 24 issue of THE MODEL ENGINEER. Mr. Dillon touches upon an important subject when he deals with cheaper tools.

Henry Ford revolutionised the motor-car industry by bringing out a car at less than half the price of other cars. People thought him crazy, but to-day everybody over here (at least) has a car and the demand as a whole increased beyond description.

A cheaper lathe would not affect the sales of the more expensive ones, no more than the Ford car has done, it would tend to create a greater following.

What we need is a "stocky" machine, lots of metal ***in the right place***, no bushings, just plain good cast iron; after all, how long do simple plain cast-iron bearings run in drilling and other machines, hand or power driven? Add to this an amateur only works a machine a few hours at nights, not day and night as in a regular shop. The average run of cheap lathes are too light to carry the chucks; a good plan would be to design the lathe for the trade stock chuck.

The little machine Stuart Turner put on the market years ago was a good weighty little machine, and had not that greyhound hungry look of similar machines of that size.

I wish Mr. Dillon every success and hope he will have a united response.—Yours truly,

P. W. WILSON.

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### What Model-Makers are Asking for.

DEAR SIR,—I duly note in your January 31 issue the various views of your readers under the above caption, particularly "Loco Sets Ready for Assembling" and also "Portable Engines for Farm Work." I may say that all the suggestions appear good, but I am just singling out two to be going on with.

Now taking the first of the above-mentioned two, I have time and time again suggested machined sets, and I note that Mr. H. Price endorses same, and very wisely points out that thousands would avail themselves of such sets. To the fellow whose work ceases at 5 p.m. all well and good, but how many professional men practically work the clock round; speaking for myself, and it applies to everyone connected with shipping, ships have a knack of misbehaving themselves at any old time, and the same reasoning attaches to a great many other lines, and which brings us down to an analysis of just what proportion of model enthusiasts have every night free; some one should get out a chart or graph showing this.

Now to number two, the portable engine. Yes, Mr. Osborne, I agree with you, and would respectfully point out that Mr. Alfred Budd designed a particularly snappy little overtype engine years ago called THE MODEL ENGINEER overtype. Surely it would be no trick to mount this engine on wheels; I suggested it a couple of years ago but got no response. Whilst on the subject of this same overtype (and I have built two), I think road wheels would add greatly to its appearance; possibly Mr. Budd or other reliable authority will give us sizes and spacings of suitable wheels for this engine. Frankly, I believe that with the alteration suggested this engine would appeal to many others besides Mr. Osborne and myself.

Now, Mr. Editor, the suggestion I make *re* the Budd overtype will not be a killing matter. That is to say, it will entail no great expense; it is merely improving upon what we already have, and if this "competition" is out to do good and is not merely a gesture, then I think some of the suggestions should be taken seriously.

To those conversant with big practice, how often do we come across inaccessible congestion; how many times do we hear the remark, "The one who designed this should have it to take adrift and put it together again." This remark carries a certain warning to the more ambitious to avoid running into modelling congested prototypes. Believe me, the prototype oft-times gives one a run for one's money; how much more so would a model? This suggests careful discrimination, particularly if working to a small scale.—Yours faithfully,

P. W. WILSON.

Ohio.

### Wanted: Design for Water-heating Apparatus.

DEAR SIR,—I have been watching the recent correspondence in THE MODEL ENGINEER on geysers with interest. I am at present just preparing to make a new circulating cylinder for my bathroom hot-water supply. The one now in use is of twelve gallons capacity and rather inadequate. I intend replacing this by one holding twenty gallons, and to rig up the old one as some kind of water heater, gas heated for use when the kitchen fire which heats the boiler is not alight, this occurring mostly during the summer months. I have enquired among several engineering friends for enlightenment on the internal arrangement of geysers but without success. To my mind something arranged on the flash boiler principle could be made to suit my needs, and I intend working on this theory when the time comes if I cannot find anything more suitable.

I am rather in the dark as to the amount of tubing to use and the best arrangement of same coupled with ease of construction. Perhaps some other reader has experimented in this direction and would be willing to pass the result of his experience on for the benefit of fellow readers who, like myself, may be just waiting for it. What I am aiming at is something which will give enough hot water for a bath within about half an hour from lighting up.

Mr. Geoffrey Caryll mentioned in the February 14 issue that an article on the subject by an expert would be welcomed, and as I do not remember anything of practical value appearing in THE MODEL ENGINEER during the last twenty years, I think such an article would make a very fitting subject for the domestic column, and would be greatly appreciated by the apparently growing band of readers who, like myself, find pleasure and amusement in reading articles on models, but prefer to make a hobby out of the numerous domestic engineering jobs which keep cropping up.—Yours truly,

"SITU."

Wallsend-on-Tyne.

## INSTITUTIONS AND SOCIETIES.

### The Society of Model and Experimental Engineers.

WORKSHOP.—Monday, April 8, Rummage Sale. Apart from the interest of a rummage sale as such, and they *are* interesting, these are always jolly affairs. You cannot feel depressed during the sale however much your general affairs are worrying you. Further demonstrations shortly.

DINNER.—On Saturday, April 20, at Pritchard's Restaurant. Tickets are ready and may be obtained of the Secretary or any member of the Council, price 7s. 6d. each.

If you are not a member and would like to know more about the Society, write to the Secretary for details and a card of invitation to one of the meetings. His address is, R. W. WRIGHT, 202, Lavender Hill, Enfield, Middlesex.

### Junior Institution of Engineers.

Friday, April 5, at 39, Victoria Street, S.W.1, at 7.30 p.m., informal meeting; technical meeting showing the production of Graham-Paige Cars in America.

### Manchester S.M. and E.E.

NEXT MEETING.—April 12, general night. No meeting on March 29. We had a good show of locomotives working on the track at our last meeting; quite a number are being built.

Hon. Secretary and Treasurer, W. E. WOOD, 20, Albert Place, Longsight, Manchester.

### Institute of Patentees.

The following inventions have been received during week ending March 16: Improvements in the following article of commerce: valves for preventing the unauthorised use of petrol or other liquids; combined kinematograph and acoustic films; piston or junk rings; bolts, studs and the like; gears in automobiles; show cases; blocks for building construction; vehicles, more particularly trucks, trolleys and the like. A detachable heel piece for boots or shoes has also been patented.

Secretary, G. DRURY COLEMAN, 39, Victoria Street, S.W.1.

### Leicester Society of Model Engineers.

NEXT MEETING.—Friday, March 29, at 8 p.m., in Swiss Café, Welford Road.

Secretary, J. H. RILEY, "Earlsdon," Scraptoft Road, Leicester.

## Notice.

The Editor invites correspondence and original contributions on all small power engineering, motor and electrical subjects. Matter intended for publication should be clearly written on one side of the paper only, and should invariably bear the sender's name and address. It should be distinctly stated, when sending contributions, whether remuneration is expected, or not, and all MSS. should be accompanied by a stamped envelope addressed for return in the event of rejection. Readers desiring to see the Editor personally can only do so by making an appointment in advance.

All subscriptions and correspondence relating to sales of the paper and books to be addressed to Percival Marshall & Co., 66, Farringdon Street, London, E.C.4. Annual Subscription, £1 1s. 8d., post free to all parts of the world.

All correspondence relating to Advertisements and deposits to be addressed to THE ADVERTISEMENT MANAGER, "The Model Engineer," 66, Farringdon Street, London, E.C.4.

Sole Agents for United States, Canada and Mexico: Spon and Chamberlain, 120, Liberty Street, New York, U.S.A., to whom all subscriptions from these countries should be addressed. Single copies, 14 cents; annual subscription, 5 dollars 50 cents, post free

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*Advertisements are inserted in these columns at the rate of* **One Penny** *per word; minimum charge for advertisement,* **One Shilling.** *Single letters or figures are charged as words, and a compound word as two words. The advertiser's name and address are charged for.*

**Advertisers who wish to separate** *their announcements into distinct paragraphs must have not less than 12 words in any one paragraph, followed by the word "Below"—which is charged for.*

**"Box" Replies,** *care of these offices, are charged 6d. extra to cover postages. The following words must appear at end of advertisement: "Box ——, 'Model Engineer' Offices," for which usual rate will be charged. (Advertisers need not include our full address.)* **When replying to a "Box No." advt.** *address your envelope: Advertiser, Box ——, "The Model Engineer," 66, Farringdon Street, London, E.C.4.*

**All advertisements in these columns must be prepaid,** *and remittances should be made by Postal Orders or Stamps, and sent to the Advertisement Manager, "The Model Engineer," 66, Farringdon Street, London, E.C.4.*

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*Advertisers are requested to send in their announcements as early in the week as possible, as although we accept advertisements up till the first post on Friday preceding the date of issue,* **we cannot guarantee the insertion of those arriving on this day.** *Telephone: Central 9071.*

### OUR DEPOSIT SYSTEM.

*We will receive from intending purchasers the purchase money of any article advertised or sold by our advertisers, and will acknowledge its receipt to both the Depositor and the Vendor, whose full names and addresses must be given. Unless otherwise arranged beforehand between the parties, it is understood that all goods are sent on approval, and that each person pays carriage one way if the goods are returned. The deposit is retained by us until we are advised of the completion of the purchase, or of the articles having been returned and accepted. In addition to the amount of the deposit, a fee of 1/- for the sum of £1 and under, and 1/6 for amounts in excess of £1, to cover postage, etc., must be remitted at the same time, and sent to the Advertisement Manager, "The Model Engineer," 66, Farringdon Street, London, E.C.4. In cases of persons not resident within the United Kingdom, double fees are charged.*

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**Fairbanks' Farm Engine,** 2½ h.-p., magneto, good condition, complete, £8.—32, Church Street, Oldbury.

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**When communicating**
with Advertisers our readers will avoid delay if they will kindly
**state requirements clearly**
—whether ordering goods or merely sending an inquiry. A stamp should be enclosed when asking for lists or particulars.

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**Vices,** Parkinson's "Handy," width 2½", 8s. 6d.; Wire Strainers, aero steel, small, 1s. 6d. dozen; Hand Drills, single gear, ¾", 3s. 6d.—Below.

**Accumulators,** 2 volts 13 amps., non-spillable chloride, 4s. 6d.; Cross Levels, 1s. 6d.; Screwdrivers, nickel plated, 7", 8d.—Below.

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**Now Here's a Garage Lathe** really cheap, by Scott, 6½"×6 ft., back-geared, compounded, T-slotted saddle, self-surfacing, self-sliding, 8" chuck, and overshaft. Mind, it's cut fine, and be quick if you want it at £6 10s. 6d.—BUTLER'S GARAGE, Littleover, Derby.

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**"General"**—*(Contd.)*

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**" Tools "**—(*Contd.*)

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**Ransome's Power Hacksaw Machine,** perfect, 50s.; 6½" Centre Gap-bed Lathe, S.S. and S.C., admitting 25" in gap, 3 ft. 6" between centres, with faceplate, chuck, countershaft, change wheels, bargain £14 10s.; Air Compressor, 2" stroke, new, 15s.; No. 2 Solid Brass Rotary Hand Pump, new, 20s.—Below.

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**We Buy, Sell or Part Exchange** all kinds of good serviceable Light Machinery, such as lathes, shapers, milling machines. Get in touch with us, we can do business with you. Distance is no bar. —Below.

**Accurate Dependable Lathe Chucks** can be obtained from us at very low prices. Take it from us, you can do a first-class job with them. Our customers have confirmed their accuracy.—KNAPTON'S MACHINERY MART Co., Wade Lane, Leeds.

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**Drummond Gap-bed Lathes,** 6" centre, hollow mandrel, latest model, nearly new condition, £30 each.—Below.

**Centaur Gap-bed Lathes,** 7" centre, nearly new condition, £28 each.—Below.

**" Mascot " Gap-bed Lathes,** 6" centre, nearly new condition, £25 each.—Below.

**The Above Is Part** of a consignment recently purchased from the R.A.F. Training College, and all are in first-class working order.—MICKLEBURGH BROS., Windsor Works, 143, Walmer Road, London, W.10.

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**Bench Drill,** 35s.; Pulleys, from 4" to 30", at 4d. per inch diameter; Hangers, Plummer Blocks, Shafting, from 1" to 3" diameter, cheap.—MICKLEBURGH BROS., Windsor Works, 143, Walmer Road, London, W.10.

**2¼" Treadle Lathe,** fully compound swivelling slide-rest, hand-rest, various chucks, £2 10s.—BOX 1191, MODEL ENGINEER Offices.

**Lathe, 6" Vulcania,** screw-cutting, S.S., back-geared, complete with countershaft, bargain £9.—Below.

**Electric Motors,** several 2 and 3 h.-p., 220 volts D.C., good condition.—WATLIFF, 175, Merton Road, Wimbledon, London, S.W.19.

**The " Utilius " 4-Tool Turret,** special for Drummond 4" lathe, hardened screws and finished bright, no fitting required, simply slips on, 13s. 6d., post 9d.—W. A. COOPER, 6, Longfield Terrace, York.

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**" Lion " Oil and Petrol Engines,** complete outfits, from £12; British made; deferred terms.—LION ENGINE Co., 166a, Pentonville Road, N.1.

**10 Brand New Galloway Portable** Steam Plants, oil fired, comprising high-pressure multitubular boiler, vertical copper tubes, complete fittings and mountings, and donkey pump, W.P. up to 150 lb., height 24"×15" diam., complete tank unit, with water pump, fuel pump, pressure chambers, etc., suitable for driving small steam engine, pumps, etc.; price £9 10s., delivered U.K.—C. DUNLOP AND Co., Bassin Loubet, Boulogne-sur-Mer, France.

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**¼ h.-p. 50-volt D.C. Motors,** 17s. 6d. each; 100-volt, 22s.; " Roneo " No. 10 Rotary Duplicators, 60s. each; late type 4-cylinder Magnetos, 20s.; Car Dynamos from 10s.; Single Magnetos slightly incomplete, 5s. each.—Below.

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**50/60-volt 10/12-amp. Charging Dynamos,** G.E.C., £5 10s. each.—Below.

**25/37-volt 15-amp. Newton Dynamos,** unused, £6 10s. each.—Below.

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**200-volt 50-amp. Electric Generating Plant,** £25. —136, London Road, Mitcham

**D.C. Motors and Dynamos.**—1/17th h.-p., 200—250-volt Motor, £1 15s.; ½ h.-p., 100—110-volt Crocker-Wheeler, no starter, £3 10s.; carriage extra.—GENTRY, 66, Farringdon Street, E.C.4.

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**Voltmeters, Ammeters,** great variety, to clear cheap.—FRANK, 67, Saltmarket, Glasgow.

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**50/60-volt 12-amp. Charging Dynamos,** £5 10s. each.—Below.

**25/37-volt 15-amp. Newton Dynamos,** £6 10s. each, unused; 50/70-volt 19-amp. Newton Dynamos, £8 each, unused.—Below.

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